

# Soil Science

## 1. SOIL AS A NATURAL BODY

- 1.1 Definition and importance of soil as a natural resource
- 1.2 The parent material of soil
- 1.3 Bedrock Weathering and Formation of Parent Material
- 1.4 Soil-Forming Processes and factors
- 1.5 Soil Bodies as Parts of Landscapes
- 1.6 Formation of A and C Horizons
- 1.7 Formation of B Horizons
- 1.8 The Bt Horizon
- 1.9 The Bhs Horizon
- 1.10 Formation of E Horizons
- 1.11 Formation of O Horizons

## 2. PHYSICAL PROPERTIES OF SOIL

- 2.1 Size distribution of soil particle
- 2.2 Soil textural classes
- 2.3 Soil structural properties and management
- 2.4 Soil density and porosity
- 2.5 Soil color
- 2.6 Soil consistence
- 2.7 Formation and Stabilization of Soil Aggregates
- 2.8 Tillage and Structural Management of Soils

## 3. SOIL WATER: CHARACTERISTICS AND BEHAVIOR

- 3.1 Structure and Related Properties of Water
- 3.2 Soil Water Energy Concepts
- 3.3 Soil Water Content and Soil Water Potential
- 3.4 The Flow of Liquid Water in Soil
- 3.5 Infiltration and Percolation
- 3.6 Qualitative Description of Soil Wetness
- 3.7 Factors Affecting Amount of Plant-Available soil water

#### **4. THE COLLOIDAL FRACTION: SEAT OF SOIL CHEMICAL AND PHYSICAL ACTIVITY**

- 4.1 General Properties and Types of Soil Colloids
- 4.2 Fundamentals of Layer Silicate Clay Structure
- 4.3 Mineralogical Organization of Silicate Clays
- 4.4 Structural Characteristics of Nonsilicate Colloids
- 4.5 Sources of Charges on Soil Colloids
- 4.6 Cation Exchange Reactions
- 4.7 Cation Exchange Capacity (CEC)
- 4.8 Binding of Biomolecules to Clay and Humus
- 4.9 What Processes Cause Soil Acidification?
- 4.10 Buffering of pH in Soils
- 4.11 Soil pH and plant nutrient availability
- 4.12 Raising Soil pH by Liming

#### **5. SOIL ORGANIC MATTER**

- 5.1 Organic Decomposition in Soils
- 5.2 Factors Controlling Rates of Residue Decomposition and Mineralization
- 5.3 Genesis and Nature of Soil Organic Matter and Humus
- 5.4 Influences of Organic Matter on Plant Growth and Soil Function
- 5.5 Amounts and Quality of Organic Matter in Soils
- 5.6 Beneficial Effects of Soil Organisms on Plant Communities
- 5.7 Nutrient cycling
- 5.8 Soil Organic Matter Management
- 5.9 Soils and Climate Change

#### **6. NITROGEN AND SULFUR ECONOMY OF SOILS**

- 6.1 Influence of Nitrogen on Plant Growth and Development
- 6.2 Distribution of Nitrogen and the Nitrogen Cycle
- 6.3 Ammonium Fixation by Clay Minerals
- 6.4 Ammonia Volatilization, Nitrification and Denitrification
- 6.5 Symbiotic Fixation with Legumes and non-legumes
- 6.6 Practical Management of Soil Nitrogen
- 6.7 Importance of Sulfur and the Sulfur Cycle
- 6.8 Behavior of Sulfur Compounds in Soils
- 6.9 Sulfur and Soil Fertility Maintenance

## **7. SOIL PHOSPHORUS AND POTASSIUM**

- 7.1 Phosphorus in Plant Nutrition and Soil Fertility
- 7.2 Effects of Phosphorus on Environmental Quality
- 7.3 The Phosphorus Cycle
- 7.4 Solubility of Inorganic Soil Phosphorus
- 7.5 Phosphorus-Fixation Capacity of Soils
- 7.6 Practical Phosphorus Management
- 7.7 Potassium in Plant and Animal Nutrition
- 7.8 The Potassium Cycle
- 7.9 The Potassium Problem in Soil Fertility
- 7.10 Forms and Availability of Potassium in Soils
- 7.11 Practical Aspects of Potassium Management

## **8. CALCIUM, MAGNESIUM AND TRACE ELEMENTS**

- 8.1 Calcium as an Essential Nutrient
- 8.2 Magnesium as a Plant Nutrient
- 8.3 Deficiency versus Toxicity
- 8.4 Micronutrient Roles in Plants
- 8.5 Sources of Micronutrients
- 8.6 Factors Influencing the Availability of the Trace Element Cations
- 8.7 Organic Compounds as Chelates
- 8.8 Factors Influencing the Availability of the Trace Element Anions
- 8.9 Soil Management and Trace element needs

## **9. SOIL EROSION AND ITS CONTROL**

- 9.1 Significance of Soil Erosion and Land Degradation
- 9.2 On-Site and Off-Site impacts of Accelerated Soil Erosion
- 9.3 Mechanics of Water Erosion
- 9.4 Models to Predict the Extent of Water-Induced Erosion
- 9.5 Conservation Tillage and Vegetative Barriers
- 9.6 Concept of watershed management
- 9.7 Control of Accelerated Erosion on Range- and Forestland
- 9.8 Wind Erosion: Importance and Factors Affecting It
- 9.9 Predicting and Controlling Wind Erosion
- 9.10 Land Capability Classification as a Guide to Conservation

## **10. GEOGRAPHIC SOILS INFORMATION**

- 10.1 Soil classification: USDA, FAO-UNESCO and WRB
- 10.2 Soil Spatial Variability and morphological properties
- 10.3 Techniques and Tools for Mapping Soils
- 10.4 Modern Technology for Soil Investigations
- 10.5 Remote Sensing in Soil Survey
- 10.6 Making a Soil Survey: mapping unit
- 10.7 Soil survey Interpretation
- 10.8 Geographic Information Systems (GIS)
- 10.9 GIS, GPS, and Precision Agriculture